

.

SOUTHERN OSCILLATION

& CLIMATIC VARIABILITY

Rob Allan

Climate Impact Group, CSIRO Division of Atmospheric Research, Mordialloc, Victoria, AUSTRALIA,

Janaire Underny

Department of Geography, Elaculty of Science, Australian National University,

Canberra, ACT, AUSTRALIA.

David Parker

Hadley Centre for Climate Prediction and Research, United Kingdom Meconological Office (UKMO)

ika da ika kana wa mana kana <mark>GDOM</mark>,



CONTENTS

FOREWORD	ii
ACKNOWLEDGEMENTS	vi
CONCEPTS AND SCENE SETTING	
I.Introduction	
El Niño and La Niña, Southern Oscillation and SOI, ENSO	
The Atmosphere: Southern Oscillation and the Southern Oscillation Inde	
ENSO Structure, Nature and Physical Characteristics	
Teleconnections	
Ocean–Atmosphere Interaction	
Recent Statistical Forecasting	29
Indo–Pacific Regional Focus	31
Climatic Variability	
ENSO Components (Quasi-Biennial and Low Frequency)	
Stationary and Propagational Aspects	39
Modelling ENSO	39
2. Data and Methods	45
Global Monthly Gridded SST Data from 1871 to 1994	45
Global Monthly Gridded MSLP Data from 1871 to 1994	
Land and Island MSLP Data from 1871 to 1994	
Checking and Correcting Land and Island Station MSLP Data Inhomog	eneities 52
Collation of Ship MSLP Data and Checking and Correcting their Inhom	ogeneities 54
Construction of the Gridded Monthly MSLP Fields	55
Calculation and Filtering of Niño 3, Niño 4 and SOI Series	57
Calculation of Correlation and Filtered Fields of MSLP and SST	
Data Sources for ENSO Phase Composites and Impact Maps	

	OCEANIC, ATMOSPHERIC AND HYDROLOGICAL	
•	Variable Responses to ENSO	
	SST, Convective Regions and Atmospheric Teleconnections	
	Rainfall (Droughts and Floods), River Discharge, Snow, Frost and Fire	
	Air Temperature	
	Sea Level	67
4. E	NSO TELECONNECTION PATTERNS IN HISTORICAL RECORDS	. 69
	Value of Simple ENSO Indices (i.e. SOI and Niño 3 and 4)	69
	Teleconnection Stability in Time and Space	69
	Spatial Patterns of Correlations of Darwin MSLP with Global MSLP in 21-year Epochs:	
	1879–1899, 1900–1920, 1921–1941, 1942–1962, 1963–1983	. 71
	Spatial Patterns of Correlations of EEP SST with Global SST in 21-year Epochs:	
	1879–1899, 1900–1920, 1921–1941, 1942–1962, 1963–1983	77
	A: Significant Scientific Contributors to the Early Evolution of ENSO B: Alexander James 'Sandy' Troup	
7. R	REFERENCES	91
	INOTATED MAPS OF CLIMATIC EVENTS AND FLUCTUATIONS: 71–1994	
8. D	DETAILED HISTORY OF SELECTED ENSO PHASES	119
	Assessment of Event History Using ENSO Impact maps: A range of El Niño a	ınd
	La Niña Phases and their Impacts Since 1871	119
	El Niño Impact Maps	120
	La Niña Impact Maps	137
9. F	ILTERED NORMALISED MONTHLY ANOMALIES OF MSLP	
	AND SST SINCE 1871	157